Geophysical Research Abstracts
Vol. 17, EGU2015-11997, 2015
EGU General Assembly 2015

Coupled mantle dripping and lateral dragging controlling the lithosphere structure of the NW-Moroccan margin and the Atlas Mountains: A numerical experiment

Sergio Zlotnik (1), Ivone Jimenez-Munt (2), and Manel Fernandez (2)

(1) Technical University of Catalonia, LaCaN, Spain (sergio.zlotnik@upc.edu), (2) Earth Sciences Institute Jaume Almera, CSIC, Spain

Recent studies integrating gravity, geoid, surface heat flow, elevation and seismic data indicate a prominent lithospheric mantle thickening beneath the NW-Moroccan margin (LAB > 200 km-depth) followed by thinning beneath the Atlas Domain (LAB about 80 km-depth). Such unusual configuration has been explained by the combination of mantle underthrusting due to oblique Africa–Eurasia convergence together with viscous dripping fed by asymmetric lateral mantle dragging, requiring a strong crust–mantle decoupling. In the present work we examine the physical conditions under which the proposed asymmetric mantle drip and drag mechanism can reproduce this lithospheric configuration. We also analyse the influence of kinematic boundary conditions as well as the mantle viscosity and the initial lithosphere geometry. Results indicate that the proposed drip– drag mechanism is dynamically feasible and only requires a lateral variation of the lithospheric strength. Further evolution of the gravitational instability can become either in convective removal of the lithospheric mantle, mantle delamination, or subduction initiation. The model reproduces the main trends of the present-day lithospheric geometry across the NW-Moroccan margin and the Atlas Mountains, the characteristic time of the observed vertical movements, the amplitude and rates of uplift in the Atlas Mountains and offers an explanation to the Miocene to Pliocene volcanism. An abnormal constant tectonic subsidence rate in the margin is predicted.